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Fiber and Yarn Properties of Smooth- and Hairy-Leaf Cotton

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ABSTRACT

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The fiber and yarn properties of four hairy-leaf and four smooth-leaf cotton varieties were investigated after gin processing that included two lint cleaner treatments. Two stages of lint cleaning improved nonlint content, leaf and composite grades, trash code, fine dust remaining in ginned lint, and waste removed by the flat strips of the card as compared with one stage of lint cleaning. However, two lint cleaners reduced length, length uniformity, strength, and break factor. Smooth-leaf varieties produced more desirable values for nonlint content, leaf and composite grades, trash code, card neps, and fine dust remaining in the ginned lint than did hairy-leaf varieties.

KEYWORDS: Cleanability, foreign matter, ginning, grade, HVI, length, lint cleaners, neps, varieties, waste.

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FIBER AND YARN PROPERTIES OF SMOOTH- AND HAIRY-LEAF COTTONS

E.P. Columbus and S.T. Rayburn

Cotton quality can be defined as anything from grade to fiber strength to maturity depending on the user of the cotton. The quality of the fibers on the plant in the field prior to harvesting is the best that can be obtained. Thus, from this point almost everything that is done to the fibers tends to reduce the quality parameters. Many factors affect the quality parameters of the cotton fibers, such as variety, weather, moisture, nutrients, insects, cultural and harvesting practices, and ginning.

Grade, which is one of the parameters used to describe cotton quality, consists of three factors: Color, leaf, and preparation. The color of the cotton is usually determined by the weather, but it can be adversely affected by insect damage and poor cultural or harvesting practices. Proper ginning practices have minimal effect on the color of the cotton; however, ginning greatly affects both leaf content and preparation. Therefore, a cotton that gins and cleans easily would produce better grades and thus improve one of the quality parameters.

One of the factors that may affect the cleanability of cotton is the amount of hair or trichomes that are on the leaves or plant parts (5). Ewing et al. (3) showed that lint from Deltapine Smoothleaf, a variety with very few hairs on the leaves, cleaned better than a hairy-leaf control variety. A preliminary study by Rayburn and Libous (6) showed that the cleanability of four varieties was affected by their degree of hairiness. A similar trend had been shown earlier by Lee and Rayburn (4). These three studies indicate that smooth-leaf cotton varieties produce higher grade values for the same ginning conditions. Williford et al. (7) showed that the dollar return per hectare was higher for smooth-leaf than hairy-leaf cottons in a 1-year study in the Mississippi Delta.

The objective of the study reported here was to evaluate the quality parameters for four smooth- and four hairy-leaf cotton varieties subjected to two lint cleaner treatments.

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MATERIALS AND METHODS

In 1984, 80 rows of about 122 m were randomly planted with 8 Midsouth cotton varieties in the same field and received the same cultural practices at the Mississippi Agricultural and Forestry Experiment Station, Stoneville, MS.[1/] Ten rows were planted with each variety. The varieties were--

1. Delta Experiment Station 422 (DES 422)
2. Deltapine 41 (DPL 41)
3. McNair 235 (McN 235)
4. Stoneville 825 (ST 825)
5. Deltapine NSL (DPL-NSL)
6. Deltapine 50 (DPL 50)
7. Deltapine 90 (DPL 90)
8. Stoneville 213S (ST 213S)

The first four varieties are hairy-leaf cottons and the last four are smooth-leaf cottons. They represent most of the cotton grown in the Midsouth and were chosen to provide a range in the degree of hairiness that affects the amount of foreign matter remaining in the ginned lint. The first seven varieties are commercially available, whereas Stoneville 213S is a smooth-leaf isoline of Stoneville 213.

On November 9, 1984, the field was spindle-picked and the harvested cotton was conditioned for 24 hours prior to ginning in the microgin facility (Anthony and McCaskill, 2). Each lot received the same seed cotton cleaning sequence, consisting of a drier (no heat), 6-cylinder cleaner, stick machine, drier (no heat), 6-cylinder cleaner, extractor-feeder, and gin stand. Two lint cleaner treatments, one or two stages of saw-type lint cleaning, were introduced into the experiment as variables. Therefore, the test was conducted as a completely randomized design, with factorial arrangements of varieties and lint cleaner treatments, and it was replicated five times. The variety factor was further classified as type of variety (hairy or smooth) and varieties within types. Statistical comparisons were made at the 5 and 1 percent probability levels, and "Least Significant Difference" (LSD) was used to compare treatment means.

Samples of seed cotton were collected prior to ginning for initial foreign matter and moisture content determinations, and lint samples were taken during processing for nonlint content (Shirley Analyzer ASTM D 2812), lint moisture (wet basis, ASTM D 2496), and classer's grade. A part of each lint sample was analyzed for fine dust content with a Cotton Dust Analyzer (CDA) (Anderson and Baker, 1). The remaining lint from each lot was analyzed at Cotton Incorporated's Raleigh, NC, fiber laboratory.

At Cotton Incorporated, each sample was tested on a High Volume Instrument (HVI) system for micronaire, length, length uniformity index, strength, elongation, color, and trash. Two micronaire readings per sample were made although four readings per sample were performed for all other fiber properties. In order to have samples of sufficient size for carding, the five replicate samples of each treatment were then combined to make two larger replicate samples for each treatment. This gave 32 samples for the spinning tests.

1/ Although the data on which this publication is based were collected in 1984-85, the findings are still valid and useful as guidelines for further research on the effects of ginning practices on cotton quality.

Each combined sample was placed in a Fiber Controls hopper, where the sample was opened and blended. The fiber then was passed through a Fiber Controls Model 310 fine opener and was chute-fed to the card operating at 40 pounds per hour. All 32 samples were processed through this same sequence of machinery.

The amount of waste removed at the 310 fine opener, the under card, and the card flat strips and the dust released during carding were measured for each sample. Six boards for card web nep counts were collected from each sample. Ten bobbins of 18/1 Ne yarn with a 3.9 twist multiple were ring spun from each sample. The yarn samples were tested for skein strength, single-end strength and elongation, and Uster evenness and imperfection counts (thin places, thick places, and neps). Fiber fineness and maturity were measured on an IIC-Shirley Fineness/Maturity Tester (ASTM D 3813).

The average seed cotton moisture at ginning ranged from 9.2 percent for McN 235 to 10.9 percent for DPL-NSL. Seed cotton foreign matter was from 6.1 to 7.0 percent for DPL-NSL and McN 235, respectively. Lint moisture content remained fairly constant throughout the test and ranged from 5.4 to 5.7 percent. Analysis of variance showed no significant differences in seed cotton moisture, seed cotton foreign matter, and lint moisture content. Therefore, moisture content variations did not affect results for the varieties or number of lint cleaners.

Lint Quality Parameters

Nonlint content as determined by the Shirley Analyzer is reported separately as visible and total nonlint content in table 1, and both were significantly affected by varieties and lint cleaners. Total nonlint content was also affected by the interaction between varieties and lint cleaners, whereas visible nonlint content was not. However, both parameters were affected by interaction within the types of varieties. Means for visible nonlint content are shown in table 2. More detailed analysis of the effect of the significant interaction between varieties and lint cleaners on total nonlint content indicates that the differences were within both smooth- and hairy-leaf varieties. Also, the number of lint cleaners affected some of the smooth- and hairy-leaf varieties differently. The difference in DES 422 for the one and two lint cleaner treatments was 1.12 percent, whereas for DPL 41 the difference was only 0.30 percent; both varieties are hairy. The differences for the lint cleaner treatments for DPL-NSL and DPL 90 were 10 and 69 percent, respectively, for two smooth-leaf varieties. Also, the nonlint mean for each smooth-leaf variety was less than for the hairy-leaf variety within each lint cleaner treatment. The

means for the visible nonlint contents of all the smooth-leaf varieties were lower than those of the hairy-leaf cottons. Visible nonlint content was significantly higher for the one lint cleaner treatment (1.61 percent) than for the two lint cleaner treatment (1.13 percent).

Grade index assigned by USDA classers was converted to a linear statistical index for statistical analysis, with 100 being Middling grade and 85 being Low Middling grade. The composite grade is a combination of the color and leaf grades. Color grade was not affected by varieties or by lint cleaners (table 1). Both leaf and composite grades were significantly affected by varieties and lint cleaners. Leaf grade was also affected by the interaction between lint cleaners and varieties as well as interactions within types of varieties. Means for composite grade are shown in table 3. Examination of the significant interaction between lint cleaners and varieties on leaf grade indicates the same trends as seen for the total nonlint content data. The effects of lint cleaner treatments on leaf grade are different, both within the hairy and smooth varieties as well as across all varieties (table 2). The difference in leaf grade for DES 422 for the one and two lint cleaner treatments was 5.4, whereas the difference was only 1.8 for DPL 41 (both are hairy-leaf varieties). For two smooth-leaf varieties, DPL-NSL and DPL 90, the lint cleaner treatment differences were 4.4 and 2.4, respectively. Although there are significant differences in the variety means for composite grade, there is not a clean break between the hairy- and smooth-leaf varieties. However, the best grade (89.3) is associated with ST 213S and the worst grade (83.0) with McN 235, the smoothest and hairiest varieties, respectively (table 3).

Maturity ratio, mature fibers, and fineness were affected by varieties as shown in table 1. Significant differences were also detected in fineness means within variety types. The means for maturity ratio and mature fibers, shown in table 3, follow the same trend, with DPL 90 having the highest value for both parameters. The fineness values ranged from 155.0 to 172.9 millitex. There were significant differences as seen in table 3, but the differences were within both the hairy- and smooth-leaf cottons.

High Volume Instrument (HVI) Parameters

HVI micronaire values were affected by varieties and within variety types as seen in table 4. The means in table 5 ranged from a high of 4.3 for ST 825 to 3.8 for DPL 41. These values are within the so-called "premium range" and varied across the hairy- and smooth-leaf varieties.

The Upper Half Mean (UHM) length was affected by varieties, lint cleaners, the interaction between varieties and lint cleaners, and within variety types and lint cleaners by variety types. A detailed analysis of this significant interaction revealed that the variation was in the smooth-leaf varieties, which ranged from 2.77 cm for DPL-NSL to 2.90 cm for DPL 50 for the one lint cleaner treatment (table 6). Also, the differences for the two lint cleaner treatment involved DPL 50 at 2.87 cm and four varieties at 2.79 cm--DES 422, McN 235, DPL 90, and ST 213S.

Length uniformity was affected by lint cleaners, varieties, and within variety types (table 4). Means ranged from 81.0 percent for ST 213S to 82.5 percent for McN 235 (table 5). Although this range is not very great, the differences were significant and varied across both hairy- and smooth-leaf varieties. The one lint cleaner treatment had a higher length uniformity than the two lint cleaner treatment.

Fiber strength was significantly affected by varieties and lint cleaners and within variety types, whereas elongation was affected by varieties and within variety types (table 4). Strength values ranged from a high of 25.1 g per tex for DPL 90 to a low of 21.5 g per tex for DPL-NSL (table 5). Both are smooth-leaf varieties. The difference between the lint cleaner treatments is small but might be due to a reduction in the length of some of the longer fibers. Elongation ranged from 8.0 percent for DPL-NSL to 4.8 percent for ST 825, or from very high to very low in the descriptive terms of the Agricultural Marketing Service (table 5).

Reflectance (percent Rd) and yellowness (+b) were both affected significantly by varieties and within variety types (table 4). All the varieties had similar reflectance values except McN 235, which had the lowest value (table 5). The yellowness values ranged from 9.6 for ST 213S to 8.5 for ST 825 (table 5). They varied independently of the degree of hairiness of the different cottons. Trash code values were significantly affected by lint cleaners and varieties (table 4). These values, as shown in table 5, ranged from 2.4 for ST 213S to 3.4 for McN 235. Trash code values followed the trend of the nonlint content, with the lowest values associated with the smooth-leaf varieties. The two lint cleaner treatment had a lower trash code value than the one lint cleaner treatment, which corresponds to the lower nonlint content.

Yarn Quality Parameters

Analyses of variance for neps counted on card webs as well as those detected by the Uster Evenness Tester are shown in table 7. The card neps were affected by varieties, lint cleaners, and the interaction between lint cleaners and varieties, whereas the Uster neps were affected by varieties and the interaction within variety types. A closer look at the significant interaction between varieties and lint cleaners on the card neps revealed the differences were within the hairy-leaf varieties. Also the effects of the lint cleaning treatments were different for the various hairy-leaf varieties. For example, there were 21 and 16 neps per 645 cm^2 for DES 422 and McN 235 for the one lint cleaner treatment, whereas the values were 24 and 36 neps per 645 cm^2 for DES 422 and McN 235 for the two lint cleaner treatment (table 6). The means for Uster neps showed differences between varieties (table 6), but these differences could not be separated between smooth- and hairy-leaf varieties. These values ranged from a low of 26 per 914 m for DPL 90 to a high of 80 per 914 m for ST 825.

Total Uster imperfections were significantly affected by varieties and within variety types as shown in table 7. The means ranged from 325 per 914 m for DPL 90 to 536 per 914 m for ST 825 (table 3). Uster imperfection values followed the same trend as the Uster neps for the variety effect. Uster evenness percent was also significantly affected by varieties and within variety types (table 7). Means for Uster evenness are shown in table 8 and ranged from 16.4 percent for DPL 90 to 17.5 percent for ST 825 and DPL 50. This trend was the same as seen for the values for both Uster neps and total imperfections.

Single-end break strength was significantly affected by varieties and within variety types (table 7). Means for these data ranged from a low of 13.7 g per tex for DPL-NSL to a high of 16.0 g per tex for DPL 90 (table 8). Differences in single-end break strength for the yarns could not be distinguished between hairy- and smooth-leaf varieties. Elongation for the yarns was affected by varieties and within variety types (table 7).

Means for yarn elongation, as shown in table 3, ranged from 6.8 percent for ST 825 to 8.0 percent for DPL 50. These values follow closely the fiber elongation, as shown in table 5. Yarn break factor was affected by varieties, lint cleaners, and within variety types (table 7). The highest break factor was associated with DPL 90 and the lowest with DPL-NSL (table 3). The one lint cleaner treatment had a higher break factor than the two lint cleaner treatment, 2566 and 2509, respectively. Trends in these data follow very closely those seen for the single-end break strength (table 8) and the fiber strength (table 5).

Dust and Processing Waste Parameters

CDA fine dust or dust remaining in the ginned lint was significantly affected by varieties, lint cleaners, and within variety types (table 9). Means for the CDA dust, as shown in table 5, ranged from 16.3 to 18.6 mg per 20 g of lint for ST 213S and McN 235, respectively. The values were lowest for the smooth-leaf varieties except ST 825, a hairy-leaf variety, which also contained a low amount of fine dust. Means for the two lint cleaner treatment were 15.0 mg per 20 g lint as compared with 19.2 mg per 20 g lint for the one lint cleaner treatment. The respirable dust sampled in the exhaust from the card by the Continuous Aerosol Monitor (CAM) was not significantly affected by varieties nor lint cleaner treatments (table 9). This fact was not expected since there is usually a high correlation between CDA dust and respirable dust.

Processing waste removed under the card and by the 310 opener was not significantly affected by varieties or lint cleaner treatments (table 9). Waste removed by the card flat strips was significantly affected by varieties, lint cleaners, and within variety types (table 9). Means in table 3 show that the highest and lowest values were associated with two smooth-leaf varieties, 1.60 and 1.88 percent for DPL 90 and DPL 50, respectively. Waste removed by the flat strips was 1.69 percent for the two lint cleaner treatment and 1.79 percent for the one lint cleaner treatment.

Table 1
Analyses of variance for lint quality parameters

Source of variation	Degrees of freedom	F-values for-- Visible nonlint	Total nonlint	Leaf grade	Color grade	Composite grade	Maturity ratio	Mature fibers	Fineness
Variety	7	7.38**	7.40**	19.81**	0.52ns	4.00**	3.07**	3.10**	7.86**
Var (Smooth)	3	1.58ns	3.01*	6.98**	.15ns	3.64*	6.05**	6.07**	6.84**
Var (Hairy)	3	3.56*	3.88*	3.26*	.82ns	.88ns	.80ns	.88ns	10.50**
S vs. H	1	36.25**	31.14**	107.93**	.72**	14.42**	.93ns	.82ns	2.98ns
Lint cleaners	1	49.95**	44.09**	20.62**	3.93ns	10.33**	2.31ns	2.04ns	1.89ns
LC*Var	7	1.20ns	2.86*	2.21*	.96ns	1.61ns	1.10ns	1.21ns	.37ns
LC*(S vs. H)	1	4.08*	6.90*	5.16*	.13ns	.65ns	.01ns	.02ns	.04ns
LC*Var(S)	3	.80ns	1.90ns	1.20ns	.62ns	1.84ns	1.14ns	1.23ns	.18ns
LC*Var(H)	3	.65ns	2.47ns	2.24ns	1.59ns	1.70ns	1.43ns	1.59ns	.67ns
Error	64								

ns = nonsignificance at 5% level of probability.
* = significance at 5% level of probability.
** = significance at 1% level of probability.

Table 2
Means for visible and total nonlint and leaf grade separated by variety and lint cleaners

Type and variety	Visible nonlint, %			Total nonlint, %			Leaf grade, index		
	Lint cleaner		Variety	Lint cleaner		Variety	Lint cleaner		Variety
	1	2	mean	1	2	mean	1	2	mean
Hairy									
DES 422	1.90	1.17	1.53	4.03	2.91	3.47	86.8	92.2	89.5
DPL 41	1.56	1.16	1.36	3.51	3.21	3.36	90.4	92.2	91.3
McN 235	2.10	1.49	1.80	4.19	3.56	3.88	85.0	88.6	86.8
ST 825	1.94	1.23	1.58	4.04	3.14	3.59	85.0	94.0	89.5
Mean	1.88	1.26	1.57	3.94	3.20	3.58	86.8	91.7	89.3
Smooth									
DPL-NSL	1.33	1.23	1.28	3.30	3.20	3.27	95.2	99.6	97.4
DPL 50	1.45	1.06	1.26	3.56	3.09	3.32	94.0	94.6	94.3
DPL 90	1.31	.81	1.06	3.34	2.65	3.00	94.0	96.4	95.2
ST 213S	1.23	.88	1.06	2.97	2.90	2.93	100.8	100.0	100.4
Mean	1.33	.99	1.16	3.29	2.97	3.13	96.0	97.6	96.8
Lint cleaner mean	1.61	1.13		3.62	3.09		91.4	94.7	
LSD (Type x Var x LC)	.60			.71			6.5		
LSD (Type x Var)	.42			.50			4.6		
LSD (Type x LC)	.30			.36			3.2		
LSD (Type or LC)	.21			.25			2.3		

Table 3
Treatment means for selected fiber, yarn, and processing waste parameters

Type and variety	Composite grade, index	Maturity ratio	Mature fibers, %	Fineness, millitex	Uster imperfections, No./914 m	Yarn elongation, %	Preak factor	Flat strips waste, %
Hairy								
DES 422	85.0	0.91	80.6	157.5	406	7.6	2574	1.73
DPL 41	84.8	.91	81.0	156.4	378	7.3	2602	1.64
McN 235	83.0	.91	80.6	158.4	328	7.1	2710	1.82
ST 825	84.5	.94	83.0	172.9	536	6.8	2374	1.88
Mean	84.3*	.92	81.3	161.3	412	7.2*	2565*	1.77
Smooth								
DPL-NSL	87.4	.92	81.7	168.5	494	7.9	2330	1.70
DPL 50	85.1	.91	80.8	167.2	516	8.0	2412	1.88
DPL 90	85.9	.99	86.3	155.0	325	7.5	2756	1.60
ST 213S	89.3	.90	79.5	166.2	381	7.3	2542	1.70
Mean	86.9*	.93	82.1	164.2	429	7.7*	2510*	1.71
1 lint cleaner	84.5	.92	81.1	163.9	397	7.4	2566	1.79
2 lint cleaners	86.7	.93	82.3	161.6	444	7.5	2509	1.69
LSD	2.7	.05	3.4	6.8	103	.3	83	.16

*Type means in column are significantly different according to LSD.

Table 4
Analyses of variance for HVI parameters

Source of variation	Degrees of freedom	F-values for-- Micronaire	UHM length	Length uniformity	Strength	Elongation	Reflectance	Yellowness	Trash code
Variety	7	17.96**	7.24**	3.63**	35.09**	17.55**	3.17**	9.83**	5.50**
Var (Smooth)	3	6.25**	14.00**	2.84**	65.95**	22.77**	1.40ns	11.15**	.59ns
Var (Hairy)	3	28.48**	1.88ns	5.16**	9.32**	2.21ns	4.99**	2.46ns	.28ns
S vs. H	1	21.53**	3.03ns	1.39ns	19.81**	50.00**	3.01ns	27.99**	35.88**
Lint cleaners	1	.04ns	12.78**	22.26**	5.89*	.92ns	2.48ns	1.98ns	30.74**
LC*Var	7	1.51ns	3.10**	1.49ns	1.05ns	.63ns	.95ns	1.65ns	.69ns
LC*(S vs. H)	1	.60ns	.21ns	3.13ns	1.75ns	.03ns	.09ns	.54ns	.18ns
LC*Var(S)	3	1.56ns	6.38**	1.91ns	.48ns	.83ns	.48ns	1.30ns	.87ns
LC*Var(H)	3	1.76ns	.78ns	.52ns	1.38ns	.62ns	1.67ns	2.37ns	.68ns
Error	64								

ns = nonsignificance at 5% level of probability.
* = significance at 5% level of probability.
** = significance at 1% level of probability.

Table 5
Treatment means for HVI parameters and CDA fine dust content

Type and variety	Micronaire	Length uniformity, %	Strength, g/tex	Elongation, %	Reflectance, Rd	Yellowness, +b	Trash code	Fine dust, mg/20 g
Hairy								
DES 422	3.9	81.6	21.6	5.5	66.0	8.7	3.3	18.1
DPL 41	3.8	81.2	22.3	5.7	67.0	8.7	3.2	17.2
McN 235	3.9	82.5	23.0	5.1	63.6	8.9	3.4	18.6
ST 825	4.3	81.7	21.7	4.8	66.2	8.5	3.3	16.4
Mean	4.0*	81.8	22.1*	5.3*	65.7	8.7*	3.3*	17.6*
Smooth								
DPL-NSL	4.2	81.8	21.5	8.0	65.8	9.1	2.5	16.9
DPL 50	4.2	81.5	21.8	7.5	65.8	8.8	2.6	16.6
DPL 90	4.1	81.9	25.1	5.8	67.3	8.9	2.8	16.8
ST 213S	4.0	81.0	22.7	5.4	67.1	9.6	2.4	16.3
Mean	4.1*	81.6	22.8*	6.6*	66.5	9.1*	2.6*	16.6*
1 lint cleaner	4.0	82.0	22.6	6.1	65.8	8.8	3.3	19.2
2 lint cleaners	4.1	81.2	22.3	5.9	66.5	9.0	2.6	15.0
LSD	.1	.7	.6	.8	1.9	.3	.5	1.5

*Type means in column are significantly different according to LSD.

Table 6
Means for UHM length, card neps, and Uster neps separated by variety and lint cleaners

Type and variety	UHM length, cm			Card neps, No./645 cm^2			Uster neps, No./914 m		
	Lint cleaner		Variety	Lint cleaner		Variety	Lint cleaner		Variety
	1	2	mean	1	2	mean	1	2	mean
Hairy									
DES 422	2.84	2.79	2.82	21	24	22	51	38	44
DPL 41	2.84	2.82	2.84	16	26	21	43	28	36
McN 235	2.82	2.79	2.82	16	36	26	56	34	45
ST 825	2.84	2.82	2.82	23	24	24	88	72	80
Mean	2.84	2.79	2.82	19	27	23	60	43	51
Smooth									
DPL-NSL	2.77	2.82	2.79	20	19	20	76	64	70
DPL 50	2.90	2.87	2.87	18	17	18	54	64	59
DPL 90	2.84	2.79	2.82	15	19	17	25	28	26
ST 213S	2.87	2.79	2.84	19	17	18	32	52	42
Mean	2.84	2.82	2.82	18	18	18	46	52	49
Lint cleaner mean	2.84	2.82		18	23		53	48	
LSD (Type x Var x LC)	.05			8			31		
LSD (Type x Var)	.05			6			22		
LSD (Type x LC)	.02			4			15		
LSD (Type or LC)	.02			3			11		

Table 7
Analyses of variance for yarn quality parameters

Source of variation	Degrees of freedom	F-values for-- Card neps	Uster neps	Uster imperfections	Uster evenness	Single-end break strength	Yarn elongation	Break factor
Variety	7	2.89*	6.16**	5.22**	3.92*	18.90**	19.08**	27.94**
Var (Smooth)	3	.37ns	6.86**	6.18**	5.55**	32.01**	11.89**	40.04**
Var (Hairy)	3	1.36ns	7.46**	5.86**	3.55**	11.05**	12.33**	22.08**
S vs. H	1	15.05**	.17ns	.43ns	.12ns	1.77ns	60.92**	7.08*
Lint cleaners	1	9.08**	1.09ns	3.39ns	2.17ns	2.56ns	.37ns	7.54*
LC*Var	7	3.70*	1.06ns	1.51ns	2.60ns	1.92ns	1.86ns	1.01ns
LC* (S vs. H)	1	9.83**	4.56*	3.89ns	9.64**	1.57ns	4.32ns	.01ns
LC*Var(S)	3	.38ns	.88ns	1.48ns	1.82ns	3.43*	1.86ns	.63ns
LC*Var (H)	3	4.99*	.06ns	.74ns	1.04ns	.52ns	1.05ns	1.72ns
Error	16							

ns = nonsignificance at 5% level of probability.
* = significance at 5% level of probability.
** = significance at 1% level of probability.

Table 8
Means for yarn evenness and single-end break strength separated by variety and lint cleaners

Type and variety	Uster evenness, %			Single-end break strength, g/tex		
	Lint cleaner 1	Lint cleaner 2	Variety mean	Lint cleaner 1	Lint cleaner 2	Variety mean
Hairy						
DES 422	17.3	16.9	17.1	14.5	14.4	14.4
DPL 41	16.8	16.6	16.7	14.8	14.7	14.7
McN 235	16.9	16.1	16.5	15.8	15.1	15.4
ST 825	17.3	17.6	17.5	14.2	13.6	13.9
Mean	17.1	16.8	16.9	14.8	14.4	14.6
Smooth						
DPL-NSL	17.2	17.7	17.4	13.8	13.7	13.7
DPL 50	17.1	17.9	17.5	13.5	14.0	13.8
DPL 90	16.4	16.4	16.4	15.8	16.2	16.0
ST 213S	16.0	17.5	16.7	14.8	13.8	14.3
Mean	16.6	17.4	17.0	14.5	14.4	14.5
Lint cleaner mean	16.9	17.1		16.9	17.1	
LSD (Type x Var x LC)	.9			.8		
LSD (Type x Var)	.6			.5		
LSD (Type x LC)	.5			.4		
LSD (Type or LC)	.3			.3		

Table 9
Analyses of variance for fine dust and processing waste parameters

Source of variation	Degrees of freedom	F-values for-- CDA fine dust	CAM fine dust	Processing waste: Under card	Flat strips	310 opener
Variety	8	2.48*	0.66ns	1.79ns	3.51*	1.43ns
Var (Smooth)	3	.23ns	.43ns	2.64ns	3.96*	.93ns
Var (Hairy)	3	3.58*	1.02ns	1.49ns	3.62*	1.11ns
S vs. H	1	5.94*	.28ns	.13ns	1.79ns	3.88ns
Lint cleaners	1	124.78**	3.28ns	.89ns	6.84*	.07ns
LC*Var	7	1.38ns	.87ns	.23ns	1.11ns	.76ns
LC*(S vs. H)	1	1.42ns	.14ns	.01ns	.02ns	.26ns
LC*Var(S)	3	1.72ns	.36ns	.30ns	.56ns	1.51ns
LC*Var(H)	3	1.04ns	1.61ns	.26ns	2.01ns	.17ns
Error	16					

ns = nonsignificance at 5% level of probability.
* = significance at 5% level of probability.
** = significance at 1% level of probability.

Fiber and yarn properties of four smooth- and four hairy-leaf cottons were investigated using two lint cleaner treatments. Seed cotton moisture, initial foreign matter, and lint moisture were not significant for cottons used in this study.

Lint quality parameters, such as visible and total nonlint content as well as leaf and composite grades, were significantly affected by varieties and lint cleaner treatments, whereas color grade was not. The smooth-leaf varieties contained less lint foreign matter and, therefore, had better leaf grades than the hairy-leaf varieties. The two lint cleaner treatment resulted in lower nonlint content and better leaf grades than the one lint cleaner treatment. Maturity ratio, percent mature fibers, and fineness were affected only by varieties.

HVI parameters of UHM length, length uniformity, strength, and trash code were affected by both varieties and lint cleaners. Of these parameters, strength and trash code differences can be separated into smooth- and hairy-leaf effects, with the smooth-leaf type having the better values. Micronaire, elongation, reflectance, and yellowness were all affected only by varieties. Mean differences for elongation and yellowness were separated into smooth- or hairy-leaf effects, with the smooth-leaf type having the higher values for both parameters.

The yarn quality parameters of card neps and break factor were significantly affected by both varieties and lint cleaners. The smooth-leaf type had lower card neps and break factor than the hairy-leaf type. Uster neps, Uster imperfections, evenness, single-end break strength, and elongation were all affected by varieties. The smooth-leaf type had a higher elongation than the hairy-leaf type. Mean differences for all other parameters were across varieties and not separated between the hairy- and smooth-leaf varietal effects.

CDA fine dust and the waste removed by the card flat strips were affected by both varieties and lint cleaners. The CDA fine dust remaining in the ginned lint was less for the smooth-leaf varieties than for all the hairy-leaf varieties except one. Mean differences for the waste removed by the card flat strips were across all varieties. The two lint cleaner treatment reduced the level of fine dust remaining in the ginned lint, and the waste removed at the flat strips was less for the lint that had been run through two lint cleaners.

CONCLUSION

Smooth-leaf varieties produced more desirable properties when subjected to one lint cleaning treatment than to the other treatment combinations.

LITERATURE CITED

1. Anderson, J.D., and R.V. Baker. 1979. Development of experimental cotton dust analyzer. Transactions of American Society of Agricultural Engineers 22(4):918-921, 925.

2. Anthony, W.S., and O.L. McCaskill. 1979. Development and evaluation of small-scale cotton ginning system. U.S. Department of Agriculture, ARS-S-36, 9 pp.

3. Ewing, E.C., Jr., E.L. Gilbert, and W.W. Bradford. 1958. The cleaning of smooth-leaved cottons. In Proceedings of Eleventh Annual Cotton Improvement Conference, Houston, TX, pp. 17-28. National Cotton Council, Memphis, TN.

4. Lee, J.A., and S.T. Rayburn. 1977. Cleanability of four upland cottons varying greatly in degree of leaf smoothness. In Proceedings of Twenty-Ninth Cotton Improvement Conference, 1977 Beltwide Cotton Production Research Conferences, Atlanta, GA, pp. 92-93. National Cotton Council, Memphis, TN.

5. Rayburn, S.T. 1985. A leaf hairiness index for nine cotton cultivars. In Proceedings of 1985 Beltwide Cotton Production Research Conferences, Las Vegas, NV, p. 434. National Cotton Council, Memphis, TN.

6. Rayburn, S.T., and L. Libous. 1983. Preliminary investigation of cleanability of cotton with varying degrees of plant hairiness. In Proceedings of Agricultural Engineers' Regional Research Committee, 1983 Beltwide Cotton Production Research Conferences, San Antonio, TX, pp. 152-153. National Cotton Council, Memphis, TN.

7. Williford, J.R., W.R. Meredith, Jr., and A.C. Griffin, Jr. 1984. Effect of variety, harvest method, and lint cleaners on cotton quality and value in 1983. In Proceedings of Cotton Improvement Conference, 1984 Beltwide Cotton Production Research Conferences, Atlanta, GA, pp. 114-115. National Cotton Council, Memphis, TN.

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